Frequently Asked Questions About LANDFIRE and Rapid Assessment Reference Condition Modeling

Contents

About LANDFIRE

What is LANDFIRE?

LANDFIRE is a 5-year, multi-partner wildland fire, ecosystem, and fuel assessment mapping project that will generate consistent, comprehensive, landscape-scale maps and data of vegetation, fire, and fuel characteristics in the United States. For more information, please visit www.landfire.gov.

What is the Rapid Assessment?

LANDFIRE includes a regional-scale Rapid Assessment, which will map and model potential natural vegetation, historic fire regimes, and Fire Regime Condition Class (FRCC). The national Rapid Assessment FRCC map will be completed in the summer of 2005 and will be used for national to regional strategic planning, broad ecological assessments, and resource allocation. It is designed to fill data needs before the entire suite of LANDFIRE products is available and will be replaced by LANDFIRE data.

What is Fire Regime Condition Class (FRCC)?

FRCC is a measure of departure of current vegetation (fuel) and fire regime conditions from reference conditions (Hann et al. 2004). A complete definition, background information, and the nationally consistent methodology for calculating and mapping FRCC are available at www.frcc.gov.

How is LANDFIRE related to Fire Regime Condition Class (FRCC)?

LANDFIRE and the Rapid Assessment will both map FRCC for the nation. Reference condition models developed for LANDFIRE and the Rapid Assessment will be available for calculating FRCC for regional and local planning using the FRCC Guidebook methods (Hann et al. 2004). LANDFIRE and Rapid Assessment FRCC maps are intended to provide data for areas without regional or local FRCC maps.

Will LANDFIRE replace regional and local FRCC mapping efforts?

No. LANDFIRE will provide standardized FRCC data (including a FRCC map, reference models and the data layers needed to map FRCC) for the nation. Local data for FRCC mapping may be finer resolution or be able to distinguish local variability and special considerations better than the national LANDFIRE data (e.g., localized occurrence of invasive species). In many cases, LANDFIRE will provide FRCC maps for lands currently lacking data (e.g., private lands within project landscapes).

Why does my agency support LANDFIRE?

LANDFIRE meets agency and partner needs for data to support fire management planning, prioritization of fuel treatments, collaboration, community and firefighter protection, and effective resource allocation and is considered critical to the National Fire Plan, the Healthy Forests Initiative, and the implementation of the Healthy Forests Restoration Act. For more information, see the Letters of Support from your agency, available at www.landfire.gov.

Why is The Nature Conservancy (TNC) involved in LANDFIRE?

TNC is involved because LANDFIRE will bolster the scientific foundation for restoring altered fire regimes, and for fire and resource management in the US. TNC will use LANDFIRE data in

collaboration with partners for conservation planning, threat assessments, and measuring success. TNC plays a critical role in LANDFIRE: development of quantified reference conditions for all vegetation types within the United States.

About Reference Conditions

What are reference conditions?

Reference conditions are the characteristic mosaic of vegetation (e.g., composition and structure) and occurrence of disturbances (e.g., frequency and severity) under the historic range of variability. Reference conditions are used to calculate Fire Regime Condition Class (FRCC) and can be used as a baseline measurement. Reference conditions do not necessarily equal desired future conditions, however, because desired future conditions may integrate many other values (e.g., communities at risk, management of threatened species, hydrology).

How are you defining Historic Range of Variability (HRV)?

We define HRV as the conditions that would have existed prior to EuroAmerican settlement under current climatic conditions. HRV does not represent a snapshot in time or a specific period in Earth's history, rather a central tendency that would occur today if modern human interference were removed. Since data about pre-EuorAmerican conditions differ across the U.S., we rely on whatever information is available about historic conditions, including fire history studies, historical photographs, vegetation succession patterns, species adaptations to disturbance, and other local knowledge.

Why are reference conditions represented as a central tendency, rather than a range of values?

Because data varies greatly across different ecosystems in the United States, we take the range of values representing HRV from the literature, select a central tendency, and model it in VDDT. We also ask experts to document the range of fire frequency by severity class for each model. In LANDFIRE, VDDT results will be put into the LANDSUM model (Keane et al. 2002), and a range of values will result based on spatial and climate variability.

What about climate change?

We recognize that climate change and climate variability can play a critical role in defining reference conditions. Experts can document how contemporary climate change trajectories might affect vegetation conditions where they have data. Climate variability is often reflected in the frequency of other disturbances (e.g., the effects of El Niño on fire frequency in the Southwest), so is captured in the probability of those disturbances. VDDT models also allow managers to test alternative climate scenarios and climate variability. LANDSUM (Keane et al. 2002) integrates climate variability into spatial simulations of reference conditions, so beyond the Rapid Assessment, climate variability will be addressed to some degree.

About PNVG & Ecological Systems

What is Potential Natural Vegetation (PNV)?

PNV is the classification used by the Rapid Assessment to characterize the biophysical characteristics of a landscape. PNV is labeled by the vegetation that would exist under the historic range of variability with natural disturbances and in the absence of modern human interference.

Why are we using Potential Natural Vegetation Groups (PNVG) in the Rapid Assessment?
We are using PNVG because it is the only nationally consistent mapped classification that currently exists. PNVG was first mapped by Kuchler (1964) and then remapped for the Coarse Scale mapping project (Schmidt et al. 2001). The PNVG map resulting from the Rapid Assessment will be a further refinement of the Coarse Scale map and data based on expert input.

What are Ecological Systems?
For LANDFIRE, we will be modeling Ecological Systems (Comer et al. 2003), a national, hierarchical classification. Ecological Systems grounds vegetation in the landscape using a multi-factor classification approach and incorporates spatial (e.g., soil patterns) and temporal (e.g., succession) patterns on the landscape. Diagnostic classifiers include vegetation structure and composition, disturbance regimes, ecological divisions, bioclimate, ecological dynamics, and landscape juxtaposition. Ecological Systems is linked directly to the National Vegetation Classification (NVC) and is strongly related to Potential Natural Vegetation (PNVG). For more information, please see http://www.natureserve.org/getData/ecologyData.jsp.

What if we have an existing regional classification that we like better?
Undoubtedly, there are regional classifications that are preferred over PNVG and Ecological Systems for local applications. However, given the requirements of the Rapid Assessment and LANDFIRE, we must use a nationally consistent classification. It is important to cross-walk PNVG and Ecological Systems with existing regional classifications whenever possible, and modeling workshops and model documentation will provide opportunity to do this.

About VDDT Modeling

Why are we creating quantitative models?
We create quantitative models because we need to establish reference conditions for FRCC assessments for all vegetation types nationwide in a scientifically consistent fashion. In many systems, we don't have precise data to determine reference conditions for vegetation or fire regimes and modeling helps fill in data gaps. Models also help us document and test our assumptions, arrive at consensus, and capture existing knowledge about the patterns and processes that operate on landscapes.

What is VDDT?
The Vegetation Dynamics Development Tool (VDDT; Beukema et al. 2003) is a public-domain, state-and-transition model that provides a framework for quantifying the rate and effects of succession and disturbance on a landscape. Users partition the landscape into states (e.g., combinations of cover and structure) and define the transitions (e.g., disturbances and succession) that cause movement between classes.

Why are we using VDDT instead of another model?
Although other quantitative state-and-transition models exist, VDDT (Beukema et al. 2003) has been selected as the model of choice for nationally consistent fire and fuels projects (including LANDFIRE and FRCC) because:

- It is public domain, free and accessible to all (you can download it at www.essa.com).
- It is a mature and time-tested model.

- It is user friendly and relatively easy to learn.
- It is non-spatial, so we aren't limited in places where there is a lack of spatial data and we are not limited by data storage requirements. This is critical for the Rapid Assessment, given the constraints of the project. For LANDFIRE, VDDT models will be paired with spatial data through the LANDSUM (Keane et al. 2002) model (see below).

Why do experts have to learn VDDT? Couldn't you have VDDT "drivers" so that we don't have to learn the model?

VDDT is a very user-friendly model that is already known by many experts in the field. We have tried workshops with VDDT "drivers", but by instructing participants in the model, we find that experts who document their knowledge and experience via modeling:

- develop a more in-depth understanding of model sensitivity and thus, more robust models.
- appreciate the opportunity to learn a new tool that can be applied to other resource management planning, scenario testing, and consensus-building.
- enjoy the chance to really "do" ecology—something that is often buried in typical day-to-day work by other obligations.
- apply their new skills to develop finer resolution models for their own local or regional needs.

In any case, right now there just aren't enough VDDT experts available to attend all workshops.

What are the limitations and assumptions of the VDDT model?

a) VDDT is a non-spatial model, so topographic variability and contagion are not incorporated. For LANDFIRE, VDDT models will be paired with spatial data through the LANDSUM (Keane et al. 2002) model, which will incorporate topographic variability and contagion. While non-spatial, VDDT does allow different probabilities to be assigned to each state within a Potential Natural Vegetation Group (PNVG) – i.e., you can define which seral or structural stages burn at lower probabilities than others, or not at all.

b) VDDT assumes that disturbances are probabilistic and that succession is deterministic, although there are ways to work around these limitations.

c) As in all models, garbage in = garbage out. Reference modeling via the LANDFIRE project uses a standardized methodology to ensure that information and data on fire regimes and vegetation development are used appropriately and consistently.

Why are you using a 5-box structure?

We are using a simple, standardized 5-box model to ensure consistency across the nation. The 5-box structure most closely parallels the average degree of information we have on vegetation structure and fire regimes across the nation. Models with more than 5-boxes imply that we have enough data to attribute them consistently across the nation. Models are limited to five boxes (characteristic vegetation composition and structure), but can have fewer than 5 boxes. In fact, many experts have chosen to develop rangeland models with only 3 or 4 boxes.

There are five standard classes (see table below), but these can be changed by experts to more closely match the ecological conditions of a PNVG. For example, you could have two mid-development closed boxes that differ by vegetation composition. The combinations of cover and

structure that make up each class are entirely user-defined. For example, open canopy might mean <30% cover in one PNVG and <10% cover in another. Modelers have the opportunity to document detailed information about each class in a model database during each workshop.

Class	*Cover*	*Structure*
A	Early-development	Post replacement
B	Mid-development	Closed canopy
C	Mid-development	Open canopy
D	Late-development	Open canopy
E	Late-development	Closed canopy

About Disturbances Used in Reference Condition Models

What are the fire regime groups?

There are five fire regime groups, as defined by Schmidt et al. (2001) and in the FRCC Guidebook (Hann et al. 2004). They are:

Group	*Frequency*	*Severity*
I	0-35 years	Low-moderate severity (<75% top-kill)
II	0-35 years	High severity (>75% top-kill)
III	35-100+ years	Mixed severity (25-75% top-kill)
IV	35-100+ years	High severity (>75% top-kill)
V	200+ years	High severity (>75% top-kill)

Why do you use fire regime groups?

Fire Regime Groups are used to categorize fire regimes by frequency and severity. Not every fire regime will fit neatly into one Fire Regime Group, but they help to generalize potential natural vegetation groups (PNVGs) and differentiate between PNVGs. Having such categories also facilitates mapping fire regimes, since continuous spatial data is not available for this attribute, and provides easy reporting at the national level.

Can you model disturbances other than fire?

We can and do model any type of relevant disturbance. We have a suite of pre-defined disturbances, including wind/weather/stress; insects/disease; and native grazing, and users can add disturbance types not reflected in this list.

How does VDDT model disturbance?

Disturbances are modeled by VDDT as probabilistic occurrences. Users enter mean annual probabilities of each disturbance, and the expected pathway following each disturbance. VDDT uses probability distributions to assign disturbances at each time-step (year).

How do you model fire history data in VDDT?

Since VDDT treats all disturbances probabilistically, fire history data must be translated to probabilities. However, there are some limitations to the use of fire history data, including the scale of the analysis area and the number of samples in the study. Mean Fire Intervals (MFI) reported in the literature for surface or mixed severity fire regimes are generally point estimates

from scarred trees, whereas MFI for stand-replacement fire regimes generally come from the distribution of age classes on a landscape. Both types of fire history data are used as guidelines or starting points for estimating probabilities in models and can be adjusted incrementally until model results agree with observed conditions. Where fire history data is limited, models are parameterized with the best possible estimates and compared to expert expectations.

Are disturbance interactions captured in VDDT?
Disturbance interactions, such as beetle outbreaks preceding a fire or the effect of climate variability on the frequency of fire, can be modeled in VDDT. These types of interactions are often difficult to model, however, because we often don't have data about the relationships among disturbance types that can be applied with confidence across a PNVG.

References Cited

Beukema, S.J., Kurz, W. A., Pinkham, C.B., Milosheva, K., and Frid, L. 2003. *Vegetation Dynamics development tool, User's Guide, Version 4.4c.* Prepared by ESSA Technologies Ltd., Vancouver, BC. 239 p. Available at: www.essa.com.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems. NatureServe, Arlington, Virginia. Available at: http://www.natureserve.org/getData/ecologyData.jsp.

Hann, Wendel J. et al. 2004. *Interagency Fire Regime Condition Class Guidebook*. Available at: www.frcc.gov.

Keane, R.E., Parsons, R., and Hessburg, P. 2002. Estimating historical range and variation of landscape patch dynamics: limitations of the simulation approach. *Ecological Modeling* 151: 29-49.

Kuchler A. W. 1964. Potential natural vegetation of the conterminous United States (manual and map). Special Publication 36. New York: American Geographical Society. 116 p.

Schmidt, Kirsten M., Menakis, James P., Hardy, Colin C., Hann, Wendel J., and Bunnell, David L. 2002. *Development of coarse-scale spatial data for wildland fire and fuel management*. General Technical Report RMRS-GTR-87. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 41 p. Available at: www.fs.fed.us/fire/fuelman.